Note on the Effect of Wear on the Errors of Micrometer Screws. By David Gill, C.B., LL.D., F.R.S. Her Majesty's Astronomer at the Cape of Good Hope.

In the *Monthly Notices*, vol. xlv. p. 81, the writer gave an account of the systematic errors produced by wear in the readings of the Circle microscopes of the Cape Transit Circle. The original screws of the Circle microscopes were of gun-metal, and were in use from 1855 till 1879, when, for reasons detailed in the above-mentioned paper, it was found necessary to have new screws made. In 1880 the errors of these new gun-metal screws were rigorously investigated and found to be practically insignificant (*loc. cit.* p. 66). In 1884 September the errors of these screws were again investigated, and were found to be very considerable (*loc. cit.* p. 68). The origin of these errors is clearly traced to wear, and an elaborate discussion is given, based on the determinations of run at different screw-readings, by which corrections of the screw errors were determined for 10 epochs between 1880 January and 1884 December, and these corrections were duly applied to the observed results in the formation of the declinations of the Cape Catalogue for 1885 (*Cape Meridian Observations*, 1882–84, Introduction, pp. vi–xxi).

It was evident, however, that gun-metal screws working in brass bearings were liable to a very large amount of wear, and in 1885, before the observations for the Cape Catalogue for 1890 were commenced, a new set of steel screws was made by Messrs. Troughton and Simms. The numbering of the graduations of three of the six drum-heads was reversed in direction, and the boxes of the three corresponding micrometers were also reversed, as had already been done at Greenwich. In this way the wear of the screw-threads, resulting from the pressure of the opposing spring, creates errors which have opposite effects on the Circle readings, according as increasing readings of the head correspond with increased or diminished compression of the spring (*loc. cit.* p. 81).

The errors of these new steel screws were investigated in 1886 with the apparatus and in the manner described in the paper above quoted, and were again investigated in 1897. The results, in seconds of arc, are given in the following tables :—

Corrections for Inequalities in whole Revolutions of Microscope-Micrometer Screws.

Micr.	9r·0		0r·0		1r·0		2r·0		3r·0		4r·0		5r·0		6r·0	
	1886.	1897.	1886.	1897.	1886.	1897.	1886.	1897.	1886.	1897.	1886.	1897.	1886.	1897.	1886.	1897.
A	0·00″	0·00″	+0·02″	+0·16″	+0·09″	+0·25″	+0·11″	+0·27″	+0·12″	+0·23″	+0·09″	+0·17″	+0·03″	+0·07″	0·00″	0·00″
B	0·00	0·00	+ ·02	− ·07	+ ·01	− ·19	00	− ·31	− ·04	− ·34	− ·06	− ·29	− ·05	− ·14	0·00	0·00
C	0·00	0·00	− ·04	− ·23	− ·04	− ·27	− ·02	− ·22	− ·03	− ·21	− ·03	− ·11	− ·04	− ·07	0·00	0·00
D	0·00	0·00	+ ·06	+ ·22	+ ·07	+ ·37	+ ·06	+ ·49	+ ·06	+ ·39	+ ·04	+ ·37	+ ·03	+ ·31	0·00	0·00
E	0·00	0·00	+ ·08	+ ·22	+ ·16	+ ·38	+ ·24	+ ·44	+ ·17	+ ·43	+ ·14	+ ·32	+ ·07	+ ·03	0·00	0·00
F	0·00	0·00	− ·17	− ·17	− ·37	− ·53	− ·52	− ·63	− ·52	− ·57	− ·45	− ·47	− ·27	− ·33	0·00	0·00
Mean	0·00	0·00	−0·01	+0·02	−0·01	0·00	−0·02	+0·01	−0·04	−0·01	−0·05	0·00	−0·04	−0·02	0·00	0·00

Corrections for Periodic Error of Microscope-micrometer Screws.

Micr.	r ·0 1886.	r ·0 1897.	r ·1 1886.	r ·1 1897.	r ·2 1886.	r ·2 1897.	r ·3 1886.	r ·3 1897.	r ·4 1886.	r ·4 1897
	"	"	"	"	"	"	"	"	"	"
A	−0·04	+0·01	−0·05	+0·01	−0·02	−0·01	0·00	−0·03	−0·02	−0·03
B	+ ·01	+ ·01	− ·06	− ·01	− ·07	− ·02	− ·07	− ·04	− ·09	− ·05
C	− ·01	+ ·02	− ·04	− ·01	− ·06	− ·04	− ·06	− ·05	− ·02	− ·05
D	− ·06	+ ·01	− ·09	·00	+ ·02	·00	+ ·10	·00	+ ·01	− ·01
E	− ·03	+ ·01	− ·05	− ·01	− ·01	− ·01	+ ·02	− ·01	·00	− ·02
F	− ·02	− ·01	− ·01	·00	+ ·01	·00	+ ·01	·00	− ·01	·00

Micr.	r ·5 1886.	r ·5 1897.	r ·6 1886.	r ·6 1897.	r ·7 1886.	r ·7 1897.	r ·8 1886.	r ·8 1897.	r ·9 1886.	r ·9 1897.
	"	"	"	"	"	"	"	"	"	"
A	−0·03	−0·01	+0·01	+0·02	+0·06	+0·02	+0·07	+0·01	+0·02	+0·01
B	− ·08	− ·03	− ·01	+ ·01	+ ·11	+ ·05	+ ·16	+ ·06	+ ·11	+ ·03
C	+ ·03	− ·03	+ ·06	+ ·01	+ ·05	+ ·04	+ ·03	+ ·06	+ ·01	+ ·05
D	− ·12	− ·02	− ·12	− ·02	+ ·04	·00	+ ·16	+ ·02	+ ·09	+ ·02
E	− ·04	− ·02	− ·03	− ·01	+ ·03	− ·01	+ ·07	+ ·03	+ ·04	+ ·03
F	− ·01	+ ·01	+ ·01	+ ·01	+ ·02	− ·01	+ ·01	·00	− ·01	− ·01

Now the micrometers in which the readings of the head diminish as the wire approaches the head (*i.e.* as the pressure of the counter spring increases) are A, D, and E, whilst the micrometers B, C, and F are those in which the readings of the heads increase as the wire approaches the head. The effects of ten years' wear on the non-periodic errors of the screws are shown below :—

		0r	1r	2r	3r	4r	5r
		"	"	"	"	"	"
Increased readings correspond to increase of pressure of spring	B	−0·09	−0·20	−0·31	−0·38	−0·35	−0·09
	C	−0·27	−0·31	−0·24	−0·24	−0·14	−0·03
	F	−0·34	−0·16	−0·11	−0·05	−0·02	−0·06
Increased readings correspond to diminished pressure of spring	A	+0·14	+0·16	+0·16	+0·11	+0·08	+0·04
	D	+0·16	+0·30	+0·43	+0·33	+0·33	+0·28
	E	+0·14	+0·22	+0·20	+0·26	+0·18	−0·04

These results prove conclusively :—

(1) That the wear of steel screws in brass bearings is very much less than that of gun-metal screws in brass bearings.

(2) That even when steel screws are employed the changes produced by wear in the non-periodic corrections are very marked.

(3) That by reversing the direction of pressure of the counter

springs in half of the screws, the effect of wear on the mean of the micrometer readings is practically eliminated.

(4) That the effects of wear have a slight tendency to diminish the original periodic errors of the screws.

On a probable Instance of periodically recurrent Disturbance on the Surface of Jupiter. By W. F. Denning.

I wish to call the attention of observers of *Jupiter* to the desirability of carefully examining the northern hemisphere of the planet in the mornings of 1901 February to ascertain whether there occurs or has recently occurred any striking outbreak of spots on the north temperate belt in about latitude $+25°$. At intervals of little more than ten years phenomena of this kind apparently affect this region, and in the suddenness of their formation and development, as well as in their rapidity of motion, they furnish greater extremes than have been witnessed in any other latitude of the planet.

When in the autumn of 1880 I observed the north temperate belt with a string of dark spots upon it (*Monthly Notices*, 1880 November, p. 46) I remembered that the same features had been presented in 1870 and 1871. In 1891 I reobserved them, and found the velocity of the spots slower than in 1880 (*Observatory*, 1891 October, p. 330). But it may be as well to allude briefly to the several phenomena which have led me to take up the view of their periodicity.

1850 March 27.—Mr. W. Lassell observed *Jupiter* with a power of 430 on his 24-inch reflector and made a drawing of the planet (*Monthly Notices*, 1850 April), which included two marked projections from the S. edge of the N. temperate belt.

1860 February 29.—Mr. J. W. Long, F.R.A.S., observing *Jupiter* with a 5-inch refractor, power 305, noticed a curious streak or oblique belt lying between the N. temperate belt and the N. equatorial belt. The object was examined by Mr. J. Baxendell, of Southport, on March 2, 5, 7, and several subsequent occasions; and he found that it "increased greatly in size and darkness," and became much extended in longitude, though the latitude of the extremities remained the same. When first seen on February 29 the streak ranged over about 7° in longitude, but by April 9 it had reached more than half round the disc. On May 3 it had spread itself over the complete circumference of the planet, and on May 6 the two ends considerably overlapped. Mr. Baxendell estimated on several dates the times of transit of the p. and f. ends across the planet's central meridian, and I have obtained some additional ones of both the ends and the centre from their positions on a series of drawings published in *Monthly Notices*, 1860 April, and in the *Proceedings* of the Lit. and Phil.